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Frequency and Type of Use of a Home-Based, Internet Intervention for Adolescent Smoking Cessation

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Abstract

Purpose—The Internet offers a potential medium for delivering smoking cessation treatment to adolescents. However, few Internet-based cessation programs for adolescents have been evaluated. We describe adolescent use of a home-based Internet intervention to stop smoking (Stomp Out Smokes; SOS) and explore baseline characteristics associated with SOS use.

Methods—Participants were 70 adolescent smokers aged 12–18 years (50% female, 90% Caucasian) randomized to receive the SOS intervention for 24 weeks as part of a larger clinical trial. SOS comprised 40 components of which 8 were primarily interactive (e.g., discussion support group, ask an expert, quit plan) and 32 were primarily informational (e.g., managing withdrawal, medications to stop smoking). SOS use data were captured electronically, including total logins to the site, and type of SOS components used defined by page hits on the interactive and information components.

Results—A total of 7,708 SOS Web site pages (6825 interactive and 883 informational) were accessed over the 24 weeks. The highest proportion of page hits was for the discussion support group (35%) and quit plan (30%). Interactive pages were significantly more likely to be used than informational pages (median 65 vs. 6, $p < 0.001$). Males accessed fewer interactive pages compared to females ($p = 0.04$). No other baseline characteristics were univariately associated with total logins or use of informational or interactive pages.

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Conclusions—Adolescent smokers most often utilized a discussion support group and other interactive Internet based cessation components. Future studies designed to increase adolescent use, and efficacy of, Internet based cessation programs are warranted.

INTRODUCTION

The Internet offers a potential medium for delivering smoking cessation treatment to adolescents[1,2]. In 2004, 87% of adolescents ages 12–17 used the Internet[3]. However, few Internet-based cessation programs for adolescents have been evaluated. We recently reported findings from the first clinical trial testing the efficacy of a home-based, Internet cessation program (Stomp Out Smokes [SOS], n=70) compared with a clinic-based, brief office intervention (BOI, n=69)[4]. Unexpectedly, although not statistically significant, we found the smoking abstinence rate at week 24 for SOS was lower (6%) than for the BOI intervention (12%). However, SOS was associated with a significantly greater reduction in average number of days smoked than BOI ($p=0.006$). Using data from this trial, the current investigation describes how adolescents used the SOS system and adolescent characteristics associated with SOS use. While Internet-based technology offers immediate access to information and social support, there are limited data on the type of components utilized by adolescent smokers[5]. These data are important to researchers for improving the design and efficacy of Internet based interventions for adolescent smokers.

Our SOS Web site was based on CHESS (Comprehensive Health Enhancement and Support System), an extensively studied[6–8] home-based Internet intervention developed by researchers at the University of Wisconsin, Madison for adult women with breast cancer and other health conditions. While 95% of the 70 SOS participants accessed the SOS site at least once over the 24 week study period, SOS use dropped to less than one-third of participants by week 3[4]. The mean number of days of use across all participants was 6.8 ± 7.1 (median = 5, range 0–33). In this report we provide additional data on adolescent use of the SOS Web site.

Our aims were to: (1) describe the amount and type of SOS Web site use (i.e., interactive vs. informational components) and (2) explore adolescent characteristics associated with SOS use. In addition, we describe the themes which emerged from a qualitative analysis of the adolescent postings to the discussion support group and ask an expert SOS components. Based on prior research on the use of CHESS among various adult samples (e.g.,[8]), we hypothesized that the discussion support group would be the most frequently used SOS component. Furthermore, we expected that greater SOS use would be associated with less prior use of the Internet, and higher levels of motivation to quit smoking.

METHODS

Recruitment

The study was approved by the Institutional Review Boards of each participating site. The clinical trial has been described in detail elsewhere[4]. Briefly, participants were recruited from the communities in three sites: Rochester, Minnesota; Madison, Wisconsin; and Hartford, Connecticut. Eligibility criteria were: (1) 11–18 years of age, (2) provided written informed assent/consent, and parent consent if ages 11–17, (3) smoked a *total* of 10 cigarettes or more during the past 30 day period, (4) cigarettes were the *primary* tobacco product being used, and (5) were willing and able to complete treatment and follow-up assessments. Adolescents were *excluded* if they: (1) were homeless, (2) reported current (past 3 months) alcohol/drug abuse or dependence or had received treatment for alcohol/drug problem in the past 3 months, (3) met current (past 3 months) diagnosis of major depressive disorder, or (4) there was another study participant from the same household. After completing the baseline assessment, participants were randomized to receive a clinic-based brief office intervention (BOI, N=69)

or the Stomp Out Smokes (SOS) home-based Internet intervention (n=70). The 70 adolescents who received SOS are the focus of this report.

Procedures

To ensure confidentiality, participants were provided with the URL for the SOS Web site and asked to create a unique login codename and password. Access to the site was restricted to SOS participants. Of the 70 SOS participants, 53 (76%) were loaned a laptop computer. While over two-thirds reported having a computer in their home, they lacked the appropriate hardware/software on their home computer or it was not readily available (e.g., shared with other family members). All SOS participants were provided with pre-paid Internet access for 6-months. CyberPatrol (www.microsys.com/cyber), was installed on laptops loaned to participants to block access to sites containing objectionable content or images.

At baseline, participants received written instructions and ≤ 1 hour of computer training to access the Internet and navigate the SOS site. The training was standardized and the trainer read the instructions from a written script. Very little computer training was needed. During the training session, all participants sent an e-mail to the discussion support group introducing themselves by their codename.

To enhance generalizability of the study findings, our goal was to emulate a home-based, real world, adolescent use of an Internet site. Thus, no telephone or e-mail prompts, or other personal interactions to encourage SOS use were provided. The duration of SOS availability (24 weeks) was based on the use observed in studies of various health topics among adults [6]. The adolescents returned to each respective study site for assessments at weeks 4, 8, 12, 24, and 36. During these assessments, no counseling or advice to stop smoking, or prompting to use the SOS site, was provided.

SOS Intervention—The development and description of the SOS Internet intervention has been described in detail elsewhere[9,10]. Social learning theory, health communication and decision-making theories formed the conceptual basis for the SOS intervention[4]. The content of the SOS site was consistent with the USPHS clinical practice guidelines on effective tobacco use intervention[11], and updated every 6 months as needed. The reading level of the content on the site was at a sixth grade level based on the Gunning Fog Index. The architecture and design of SOS was consistent with Web usability guidelines developed by the National Cancer Institute (www.usability.gov).

In addition to the login page, there were 40 components that could potentially be accessed. Of these, eight components were primarily interactive and 32 were primarily informational (see Meis [9] for details of the content of the pages within each component). The *Interactive* components included opportunities for self expression including a private journaling, quizzes, quit plan and quit notes (e.g., personalized coping strategies and list of potential supporters), and an art gallery where users could post their work. Moreover, a private electronic mail component allowed participants to ask questions of an expert and receive responses within 24 hrs. In addition, a discussion support group consisted of an electronic mail component, which posted messages and responses to and from study participants. The *Information* components provided accurate, up-to-date information on smoking and quitting and other topics relevant to the adolescent. These included the benefits of quitting; dealing with withdrawal symptoms; managing relationships, stress and feelings; enlisting social support, and information on the tobacco industry. SOS provided information on pharmacotherapy for stopping smoking, including efficacy, side effects, and benefits of various medications, with encouragement to contact a physician if there was interest in taking a medication. In addition, SOS contained videos of personal stories -- first person accounts of teens who had quit or were trying to quit, representing various ethnic and gender backgrounds. These stories addressed barriers to

quitting and how the teens had managed these barriers. Common issues were also addressed by an extensive list of expert-answered Frequently Asked Questions.

Interventionists The ask an expert option provided responses to questions posed by participants, from a team which included two teenage paraprofessionals who were former smokers (1 female and 1 male) supervised by an experienced clinical psychologist. The teen counselors received at least 3 days of training in nicotine dependence and its treatment as well as basic counseling skills. This team also monitored the discussion support group daily, reviewing the postings but not responding to them.

Measures

Dependent Variables—Use of the SOS site was monitored electronically. The Web server automatically collected participant-specific SOS use for every login and use of SOS components. Analyses of the SOS use data excluded the initial demonstration session at baseline wherein all subjects logged on to the site and posted a message to the discussion support group. A login to the SOS site was defined as an instance when a participant used a codename and password to gain access to the SOS site. Analysis of type of use was based on page “hits” or pages accessed and use of SOS components comprising those pages. Hits to the navigation pages were excluded. Use of logins and page hits as a metric for SOS site utilization is consistent with other Web based studies conducted among adults[12].

Explanatory Variables (Baseline Characteristics)—Baseline characteristics assessed via self-administered questionnaires included in the current analysis were: age; gender; use of the Internet (little or no use, some use, a lot of use); whether or not at least one parent residing in the home was a smoker; motivation to quit (don’t really want to quit, somewhat want to quit, very much want to quit); severity of nicotine dependence as measured by the validated, adolescent version of the Fagerström Tolerance Questionnaire (FTQ)[13] and depressive symptoms assessed using the validated, 23-item adolescent version of the Hamilton Rating Scale for Depression interview[14,15].

Statistical Analysis

Spearman’s rank correlation coefficient or the two-sample rank sum test as appropriate were used to examine the univariate association between three measures of SOS use (total number of logins, total informational pages accessed, total interactive pages accessed) and the baseline characteristics specified above. The paired signed rank test was used to compare informational versus interactive pages accessed. To examine change in the percent of SOS participants using the site (logins) and average use of interactive and informational components each week during the 24-week treatment, a repeated measures analysis was performed using generalized estimating equations (GEE). In these analyses, SOS use was the dependent variable and weeks was the independent variable. The GEE models were fit with a logit link function and an autoregression (AR1) working correlation matrix. Analyses excluded the initial training/demonstration session at baseline wherein all participants logged on to the site. Two-tailed p-values ≤ 0.050 were considered statistically significant.

Qualitative analysis—Excluding the posting (page hit) made by each adolescent during the training session, there were 212 postings from adolescents to the discussion support group and 28 postings to ask an expert components. We used standard methods of content analysis[16] to explore themes in the data. First, a written transcript was generated of the postings to each component. Second, after reading all messages posted on each respective component, the first author coded the study data by marking on the written transcript. When a single posting covered more than one topic area, one code was attributed to each topic. Third, the coded data were grouped using the cut-and-paste technique. The fourth step consisted of the construction of

thematic units, explanatory sets of statements consistent within and across the postings. This more global interpretative step involved searching for patterns within and between major topic areas to draw meaningful conclusions. A summary was produced that outlined the major conceptual categories or themes. A final step in the analysis, for purposes of triangulation [17], a second investigator independently coded and interpreted the data. Discrepancies in coding or interpretation were resolved with discussion with a third investigator with expertise in adolescent smoking cessation until agreement was reached for the major themes.

RESULTS

Baseline Characteristics

The 70 participants ranged in age from 12 to 18 (mean $\pm$ SD = 15.7 ± 1.3), 50% were female, 90% were of Caucasian ethnicity, and 44% reported that at least one parent in their home was a smoker[4]. At baseline, about half (53%) had used the Internet “a lot,” 33% used it “some,” and 14% reported little or no prior use. The mean FTQ score was 4.5 ± 1.6 , median 4, range 2–8. Seventy percent reported they “very much wanted to quit smoking,” 27% reported they “somewhat wanted to quit” and only 3% indicated they “did not really want to quit.” The average Hamilton Rating Scale for Depression score was 6.8 ± 7.2 , median 4, range 0–29.

SOS Use

Figure 1 shows weekly use of the SOS site. Repeated measures analysis using GEE found the percentage of participants who logged on to SOS, and the mean interactive and information component use, decreased significantly (all $P < 0.001$) over the 24 week period.

There were 763 total logins to the SOS Web site over the 24 week period, with an average of 31.8 logins per week over the 24 weeks that participants had access to the site. Of these, 400 (52%) occurred during the first 3 weeks adolescents had access to the site. Averaged across participants, the mean number of logins was 10.9 ± 15.3 , median 6, range 0–94.

There were a total of 7,708 SOS pages accessed during the 24 weeks adolescents had access to the site (6825 interactive pages and 883 informational pages). Interactive pages were significantly more likely to be accessed (median 65, range 0–848) than informational pages (median 6, range 0–86); $P < 0.001$.

Table 1 shows the top 10 most frequently accessed SOS components, assessed by the proportion of all pages accessed that comprised these various components. Eight of the top 10 components utilized were interactive. The discussion support group was the most frequently accessed component, comprising one third of all pages accessed (35%) while the quit plan was the next most frequently used component (30%). As the number of pages within each component widely varied (range 1–126), we examined if use of the components was associated with number of pages, but there was no evidence to support this, $r = 0.16$, $p = 0.339$.

Correlates of SOS Use

Gender was univariately associated with the total number of SOS interactive pages accessed ($p = 0.04$). Males accessed fewer interactive pages (median 51, range 0–269) than females (median 93, range 0–848). No other baseline characteristics were significantly associated with interactive or informational SOS pages accessed or total logins.

Qualitative Analysis

Discussion support group—Five themes emerged from the content analysis. These themes and illustrative quotes are shown in Table 2.

Ask an expert—Twenty-eight questions were sent to ask an expert. The content of these postings revolved around one theme of requesting information about medications and other information on ways to stop smoking. For example, “*Can you discuss with me some other ways to quit smoking besides the ones listed in the how to quit smoking section of this page?*,” and “*I would like info on how to deal with the psychological aspect of stop smoking and how to stay that way.*” and “*I was going through the personal stories and I saw the name “Wellbutrin.” I asked my parents what it is, and they don’t know either. I’m hoping that one of you knows what is and where I can get more information.*”

DISCUSSION

This study reports novel findings on how adolescent smokers used SOS, an Internet, home-based system. There were marked differences in adolescents’ utilization of the SOS pages that were primarily interactive compared with those that were primarily informational (median pages accessed 65 vs. 6). Moreover, females used the interactive pages more than males (median pages accessed 93 vs. 51). The discussion support group and quit plan were the most frequently accessed SOS components as indicated by the proportion of page hits (35% and 30% respectively). Qualitative analysis of the discussion support group and ask an expert postings from adolescents indicated they were seeking support for quitting and more specific guidance on how to quit.

Consistent with prior studies evaluating CHESS[8] and Web-based studies with adult [12] and adolescent[5] smokers, the discussion support group was the most frequently accessed SOS component, but use of the ask an expert component was minimal. Among college student smokers, use of both the e-mail discussion board and ask an expert components was very low [18]. In prior CHESS studies, the ask an expert component is one of the most frequently used module[8]. Thus, adolescent smokers may have been more comfortable seeking support and advice from their peers (via the discussion support group) than with the adult or teen “experts.”

Limitations

While one strength of our investigation is that 95% of our sample accessed the SOS system at least once, overall use of the SOS site was lower than in prior CHESS modules for other conditions. Prior studies of CHESS targeted adults with varying health conditions or health crises such as a recent diagnosis of breast cancer. In contrast, SOS focused on adolescent health behavior change which may have limited use of the site. There is some literature from the alcohol treatment field[19] which suggests the research assessment protocol can affect treatment outcomes due to subject reactivity effects. It is possible that our frequent assessments could be linked to increased SOS use, but inspection of Figure 1 indicates no trend for increase in SOS use with the timing of the assessments. Another potential factor is that studies of CHESS have achieved a critical mass of participants involved at any one time but we were not able to achieve this with SOS due to our slow rate of accrual. Prior studies suggest that consumer health informatics systems such as CHESS and SOS are more effective when a critical mass of participants is active in the interactive components which build a sense of community and support[20]. We found an average of 11 logins to the SOS site per participant, with most occurring early in the period that adolescents had access to the site. While use data were averaged across the 24 weeks of the study, less than one-third of participants were accessing the site and contributing data after the third week. These adolescents may not be representative of other teen smokers with respect to their preferences for SOS components. More work needs to be done using a larger sample of adolescent smokers. In addition, only 10% of our participants were ethnic minorities, which precluded analysis of the association of SOS use and race or ethnicity. Additional studies are needed to examine Internet use patterns among adolescent smokers representing various ethnic groups.

Due to the constraints involved in conducting a rigorous clinical trial, participants were not selected at random, which limits generalizability. SOS use patterns may be different for adolescents smokers who were excluded based on the inclusion criteria (e.g., need for parental consent, major depressive disorder, current alcohol/drug abuse). Related to this, non-Internet users were included in the study, and results may have differed had we included adolescents already connected and frequently using the Internet. We found no significant association of prior Internet experience and SOS use (total logins: $r=-0.09$, $P=0.48$; total days of use: $r=-0.07$, $P=0.59$; total information page hits: $r=-0.15$, $P=0.22$; total interactive page hits: $r=-0.15$, $P=0.22$). However, the non-Internet population may not be likely to use these services outside of the context of a clinical trial (i.e., “real world implementation.”

Our preliminary findings add to the literature on adolescent characteristics associated with amount and type of use of an Internet intervention to stop smoking. However, our small sample size ($n=70$) limits generalizability of the findings and precluded multivariate analysis of adolescent characteristics associated with SOS use, or characteristics associated with each SOS component.

We used logins and page hits as our metrics for Web site utilization which is consistent with other studies[12]. Unfortunately, there were several metrics of web site utilization we did not collect including, *duration* of each session for each login, total time on the SOS site, or time spent on pages. Links made to sites *outside* the SOS site were not captured. Moreover, we did not assess the *depth of use* (e.g., whether participants actually set a quit date, made a journal entry, completed a myth quiz or quit plan) or the *specific content* of the page hits within each component, only the number of pages accessed within each component. Also, our utilization data does not take into account *number of sessions* in which a component was accessed. The number of discussion support group page hits (2685) does not match the number of postings (212) that adolescents made to this component implying that many adolescents simply viewed the postings rather than initiating or responding to postings. However, it is difficult at this stage of research to decipher what aspects of participation are most helpful.

Future Directions

Our clinical trial of SOS [4], was not able to tap the potential capabilities of the Internet versus a health care model for adolescent smoking cessation. Nevertheless, the Internet increasingly offers a viable channel to deliver smoking cessation and other health behavior change interventions to adolescents[1,2]. Despite the limitations, this report provides an initial step for research in the relatively new field of Web-based treatment for adolescent smoking cessation. The current analysis offers several insights for researchers interested in developing or refining Internet-based cessation interventions for adolescents. We recommend such interventions highlight *interactive* components, including peer-based discussion and support and specific assistance for developing a quit plan. Informational types of components could be revised to include interactive components such as self-assessments or quizzes. Such information could also be delivered through a counselor led discussion support group or through proactive guidance via an expert, coach or counselor, in contrast to stand alone Web pages that require the teens to independently access them. For example, a counselor could prompt adolescents to view certain pages based on their needs. Moreover, the optimal duration of Internet-based cessation programs for teens has not been established and requires study. Perhaps a set number of logins or pre-scheduled sessions would be helpful for increasing site usage and enhance cessation rates (e.g.,[18,21,22].). In addition, future studies should include additional metrics of Web site use as suggested above. Moreover, researchers should consider the inclusion of adolescents in their study who are already active Internet users.

Larger studies are needed to clarify the relationship between gender and use of interactive components. Some research among adults suggests that women use the Internet to nurture

relationships (e.g., send e-mail to share news and worries) whereas men use e-mail to communicate with organizations and are avid consumers of online information[3]. Indeed, women may treat information gathering as a more textured and interactive process, one that includes obtaining and exchanging information through support groups and personal e-mail exchanges[23].

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Figure 1.

Percent of SOS participants (N=70) accessing the site each week, and mean interactive and information component use each week.

Table 1
Top 10 Most Frequently Used SOS Components among 70 Adolescent Smokers

SOS Component	% (#) of Total SOS Pages Accessed ^a	Type of Component	Number of Pages for Each Component
Discussion Support Group	35 (2685)	Interactive	1
Quit Plan	30 (2297)	Interactive	39
Quit Notes	10 (743)	Interactive	24
My Journal	4 (286)	Interactive	19
Ask an Expert	3 (260)	Interactive	1
Myth Quizzes	3 (225)	Interactive	14
Real Time Chat	3 (222)	Interactive	1
Personal Stories	2 (139)	Informational	80
Art Gallery	2 (131)	Interactive	10
Video	2 (123)	Informational	3

^aDenominator for percentage is based on 7,708 total pages accessed on the SOS Web site. The remaining 30 SOS components comprised ≤1% of total pages accessed -- all were informational services. The number of pages within each component is in parentheses: Frequently Asked Questions (FAQ; 126), Quit Tips (3), Glossary (10), Planning and Preparing (3), A Day at a Time (2), Relationships (12), Me as a Nonsmoker (13), Dealing with Cravings (42), What's in a Cigarette (14), Comments (1), Getting Started (23), Quit Methods (2), Weight Concerns (4), When Others Smoke (6), Feelings (27), School Stuff (3), Triggers (2), What to Expect (6), Tips for Long-Term (1), Withdrawal (3), Health (3), They're Not Helping (4), Time Management (3), Tobacco News (4), Support Resources (6), Rewards (3), Spirituality (2), Thinking about Quitting (20), Smoking and Health (5), and Medications (27).

Table 2
Key Themes from a Qualitative Analysis of the 212 Messages Posted to the Discussion Support Group

<p>1. Need for social support for quitting from family, friends, and discussion group members</p> <ul style="list-style-type: none"> - "I feel more relaxed when I know that there are more teens out there that want to quit smoking. I know that I'm not alone." - "I was hoping I could find someone with some advice or experience who knows what I'm going through. My family thinks they can help, but they have NO CLUE what I'm going through. I hope to hear from someone." - "I've asked my mom and grandma for advice, they don't know what to do so if you have an answer please e-mail me back."
<p>2. How to deal with stressful situations without smoking</p> <ul style="list-style-type: none"> - "Does anyone have any tips to deal with hectic situations other than smoking?" - "I got really stressed out at the end of the day and had a smoke. Definitely not a good way to handle my stress, huh?"
<p>3. Reductions in cigarettes encouraged and viewed as an accomplishment in quitting</p> <ul style="list-style-type: none"> - "The trick is you have to find something you really enjoy doing and throw yourself into completely. For me it was dancing. I went dancing all the time. It kept me busy and I had a ton of fun. I think if you take it slow, and cut back, it will help you." - "I think I did really good today, I only had one, I normally have a minimum of 4 or 5, so at least I cut back, right?"
<p>4. Addiction - including how to manage withdrawal symptoms and craving</p> <ul style="list-style-type: none"> - "I'm going crazy right now because I really want a smoke. I don't know how in the world I'm going to get through this sometimes. The worst part is to sleep at night." - "Hey, I used work. When I work on cars all I want is working on cars. So I used that to keep the cravings away." - "I'm 16 and I've been smoking for 5 years and it's really hard to quit. It's to the point where I can't even go even 1 day without a cigarette and if I do then every little thing bothers me and get really ticked off."
<p>5. Staying smoke-free around other smokers</p> <ul style="list-style-type: none"> - "I was supposed to quit last Saturday but a bunch of relatives came down from Iowa that smoked and my mom let them smoke in the house and it was too hard for me to quit when they were there." - "I haven't been doing that well on smoking. Whenever I am out and about with my friends I smoke way more than I would just sitting at home chillin and does anybody know why this is?" - "Thanks for the support, I really need it. It's really hard when your friends smoke."